Stevens Institute of Technology
Department of Electrical and Computer Engineering

Spring Semester 2025

CpE 462 Introduction to Image Processing

Homework 4: Due Mar. 6.

4.1 2-D DFT and DCT are separable, and can be implemented through 1-D DFT or DCT along horizontal and vertical directional separately. For the following 2×2 image block

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

4.1.1 Calculate its 2×2 DFT

4.1.2 Calculate its 2×2 DCT

4.2 A 512x512 gray scale image contains a sinusoidal pattern as shown below.

4.2.1 Formulate this image, i.e. provide analytical expression as a 2-D discrete time function. (Hint: similar to page 14 in CpE462-5.ppt).

4.2.2 Assume the vertical period of the sinusoid is 2.5 mm, i.e. 2.5 mm per cycle, and the image is directly placed in front of the eye at 250 mm away, and the eye is 20 mm in diameter with a focal point of 3 mm from the lens, calculate <u>the period</u> of its projection on retina in distance (mm) and in degree (º).

2.5mm

250mm   3mm   10mm

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